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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 752

Joint Contribution from the Bureau of Plant Industry, WM. A. TAYLOR, Chief and the Bureau of Animal Industry, J. R. MOHLER, Chief

Washington, D. C. ▼ April 24, 1919

THE UTILIZATION OF IRRIGATED FIELD CROPS FOR HOG PASTURING

By

F. D. FARRELL, formerly Agriculturist in Charge of the Office of Demonstrations on Reclamation Projects

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SOME IMPORTANT FACTORS IN SWINE PRODUCTION ON IRRIGATED LANDS.

On nearly every irrigation project in the United States it is possible to produce pork in commercial quantities. Swine growing has proved to be one of the industries through which the irrigation farmer can utilize certain of his field crops advantageously. The importance of this industry in irrigated districts fluctuates widely from year to year in response to various changes in economic conditions. One of the most important economic factors influencing swine production in these regions is the relationship between the prices of feeds and the prices of pork. Frequent changes in this relationship have resulted in great instability in the swine industry on irrigated lands and this has led to much economic loss.

To establish the swine industry in a community requires time and continued effort. Swine growers, to be successful, must acquire skill and have some special equipment; they must develop well-bred herds of suitable breeds, and they must build up and maintain a reputation for producing a continuing supply of pork. In other words, successful swine production requires that the producer adjust his operations so as to be able to remain in the business continuously.

In the past, swine production on irrigated lands has involved too many speculative features. Farmers commonly have gone into the business extensively when prices were high, only to go out of it later when prices were low. Thus, they have incurred losses in both transactions. Besides, they have expended large sums for equipment, which deteriorated rapidly when not in use.

One of the many causes of this uneconomic practice has been a lack of information as to the possibility of utilizing certain field crops produced under irrigation and the values of these crops when measured in terms of pork production. In some instances these values have been overestimated and overstocking has resulted; in others, farmers have underestimated feed values, and have either understocked with hogs or have sold both their hogs and their feed in the mistaken belief that "the market would pay more for the feed than the hogs would." Irrigation farmers have been strongly inclined to rely exclusively on old-established methods of swine production, so that at times of advancing grain prices, swine holdings have been inordinately reduced. Too little attention has been paid to the possibilities of utilizing fully certain field crops which are peculiarly adapted to irrigation farming. Many irrigation farmers have failed to appreciate the range of field crops available to them as feed for hogs, and to understand the swine-producing possibilities of irrigation agriculture through a better use of these crops.

Most of the published data regarding the feeding values of various crops used in swine production have been secured in nonirrigated sections. These data can not always be applied safely in irrigated districts, particularly in reference to crops which are pastured by hogs or "hogged off." One of the most important points in connection with the hog-pasturing method of utilizing these crops is the labor-saving feature—a feature of great importance in the sparsely settled irrigated districts, where labor commonly is expensive and difficult to secure.

Since 1912 the Department of Agriculture has been conducting experiments at its Western Irrigation Agriculture field stations[1] in

[1] These field stations are operated by the Office of Western Irrigation Agriculture of the Bureau of Plant Industry. Since 1914 the Animal Husbandry Division of the Bureau of Animal Industry and the Office of Demonstrations on Reclamation Projects in the Bureau of Plant Industry have cooperated in this work. The State experiment stations of Montana, Nebraska, and Oregon also cooperate in the investigations in those States.

the utilization of irrigated field crops in swine production. Reports of certain features of these investigations have been made from time to time,[1] and the results secured at individual stations have been discussed. In this bulletin an attempt is made to bring together some of the more important information which has been obtained at all

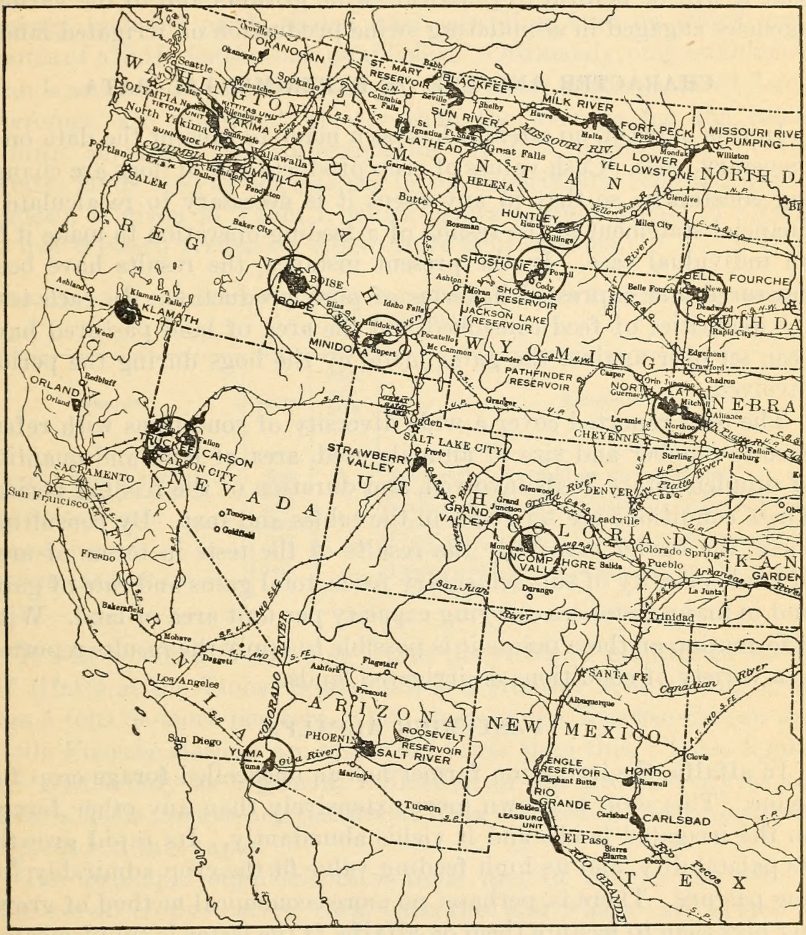

FIG. 1.—Map of the western United States, showing the location of the Government irrigation projects. The projects on which data have been obtained with reference to the utilization of irrigated crops by hog pasturing as discussed in this bulletin are shown by circles.

these stations with reference to the feed efficiency of certain irrigated field crops used as hog pasture and for hogging-off purposes. Some data which have been secured in tests[2] conducted in cooperation with

[1] See the list of publications near the end of this bulletin.

[2] These cooperative tests were supervised by the following field men employed by the Office of Demonstrations on Reclamation Projects: E. F. Rinehart, Charles S. Jones, L. E. Cline, Carl Christopher, Don G. Magruder, H. A. Lindgren, R. P. Bean, and H. A. Ireland.

irrigation farmers are also included. The locations where the information was obtained are shown in figure 1.

Many questions in this connection still need investigation, and experiments for this purpose are now in progress. This bulletin is issued as a contribution to the knowledge of the subject, in the belief that it will be helpful to practical swine growers and to the various agencies engaged in stimulating swine production on irrigated lands.

CHARACTER AND USE OF EXPERIMENTAL DATA.

In this bulletin, no attempt has been made to present the data on a monetary basis. Cash values of crop products and of hogs are changing constantly, so that in any event it is necessary to recalculate a financial statement of the results of a feeding operation to make it fit an individual case. In the present instance, the results have been measured and expressed in terms of pork production. In each test, the quantities of feed consumed and the area of land pastured have been set over against the gains made by the hogs during the period involved.

The tests reported cover a wide diversity of conditions with reference to number and size of animals used, area of land and quantity of supplementary feeds involved, and duration of the feeding period. These conditions are set forth in the tables and text. By consulting these, the reader can study the results of the tests in terms of area of land, quantity of supplementary feeds, total gains and rate of gain, and in many instances carrying capacity per unit area of land. With information on these points it is possible to apply the results reported to a variety of conditions on irrigated lands.

PASTURING ALFALFA.

In alfalfa, the irrigation farmer has an unexcelled forage crop for swine. This crop is grown more extensively than any other forage on the irrigated lands, and it yields abundantly. Its rapid growth, its palatability, and its high feeding value fit the crop admirably for hog pasture. There is, perhaps, no more economical method of growing pigs than to pasture them on alfalfa, if the latter is supplemented with the proper carbonaceous feeds. It is probable that, on the irrigated lands, with their abundance of alfalfa pasture, stocker hogs can be produced more cheaply than in any other swine-producing section of the country. Alfalfa pasture should be regarded as a basis for most of the operations of swine production on irrigated lands.

The results that can be secured with swine on alfalfa pasture depend chiefly upon the character of the animals, the stand and growth of the crop, the method of management, and the character and quantity of the supplementary feeds used. The stand and growth of the

alfalfa crop vary so widely from year to year in different fields and in different parts of the country that only an approximation can be made of the productivity of alfalfa fields in irrigated sections. In 1916, the average yield of alfalfa hay on 381,323 acres harvested on all the Government reclamation projects was 3.2 tons per acre, according to reports made by the United States Reclamation Service. This acreage included newly-seeded land as well as land on which good stands of alfalfa had become established. Ordinarily, only established stands are used as pasture for hogs. The yields of the pastured fields, therefore, are somewhat greater than the average for the entire alfalfa acreage. An approximation of the productivity of the alfalfa lands used as hog pasture in the experiments reported in this bulletin is given in Table I, which shows average yields of alfalfa at five Western Irrigation Agriculture field stations.

TABLE I.—*Average yields of alfalfa hay at five Western Irrigation Agriculture field stations.*

Station.	Years.	Yield per acre (tons).	Remarks.
Yuma (Arizona-California)	1916	5.	Estimated yield of field used for hog pasture.
Truckee-Carson (Nevada)	1916	3.	Average yield of 49 plats on good and poor soil.
Scottsbluff (Nebraska)	1913 to 1916	5.42	4-year average yield of 15 plats with established stands in field K.
Huntley (Montana)	1913 to 1916	5.79	4-year average yield of 9 plats with established stands in field K.
Belle Fourche (South Dakota)	1913 to 1916	3.73	4-year average yield of 10 plats with established stands in field A.

It will be noted from Table I that the yields of established stands of alfalfa at the Yuma, Scottsbluff, and Huntley field stations average 5 tons or more per acre, while those at the Truckee-Carson and Belle Fourche stations are somewhat lower than this. These figures are useful only as a general indication of the productivity of the alfalfa fields used as hog pasture at these stations in the experiments reported in this paper.

The principal supplementary feeds are, of course, the cereals. The cereal crops—barley, corn, oats, rye, and wheat—are grown on most irrigation projects, but in varying degrees of importance. In 1916 these crops occupied 26.1 per cent of the cropped acreage on the Government reclamation projects, while alfalfa occupied 44.5 per cent of the cropped acreage the same year. Grain sorghums are grown extensively in the Southwest where they are used both as a principal feed for hogs and as a supplement to alfalfa pasture. Rye is not grown extensively for its grain under irrigation. A general idea of the yields obtained of the four principal cereal crops grown throughout the irrigated regions of the western United States can

be had from an examination of the figures showing the average yields of wheat, oats, barley, and corn on 15 leading reclamation projects during the three years, 1913, 1914, and 1915. These figures, which include about 80 per cent of the total cereal acreage on all the Government reclamation projects during the three years mentioned, are presented in Table II.

TABLE II.—*Acreages and average yields of the principal cereal crops on 15 leading reclamation projects*[1] *during 1913, 1914, and 1915.*

Crop.	Average annual acreage.	Average yield per acre (pounds).	Rank in—	
			Acreage.	Yield.
Wheat	65,787	1,200	1	3
Oats	47,688	925	2	4
Barley	36,583	1,267	3	2
Corn	32,948	1,501	4	1

[1] These projects are the Salt River, Yuma, Uncompahgre, Boise, Minidoka (pumping and gravity), Huntley, North Platte, Truckee-Carson, Rio Grande, Klamath, Belle Fourche, Sunnyside, Tieton, and Shoshone. The locations of these projects are shown in figure 1.

Considering the yields obtained with these crops and their comparative suitability as supplements to alfalfa pasture in swine feeding, it appears that corn and barley should be grown more extensively. As long as irrigation farmers grow cereal crops to sell, it is likely that corn and barley will increase but slowly in importance. The necessity of developing live-stock industries in order to secure full utilization of the alfalfa crop and to sustain the productivity of the soil is becoming increasingly evident, however, and this is leading to a better appreciation of those cereal crops which, all things considered, are more suitable for use in feeding operations.

Since 1912 data showing the results obtained from alfalfa pasture and various supplements have been secured. These supplements include corn, barley, wheat, shorts, and milo, each used separately, and a number of mixtures of one or more of these feeds and of some additional feeds. In the following pages data are presented to show the results secured on alfalfa pasture, first, without supplements, and, second, with supplements of various kinds.

PASTURING ALFALFA WITHOUT SUPPLEMENTARY FEED.

It has been generally assumed that maximum returns can not be secured by pasturing alfalfa with swine unless a supplementary feed is used, and the few tests which have been conducted have supported this assumption. The results obtained in three tests at the Scottsbluff Experiment Farm and one on the Tieton Reclamation Project are shown in Table III.

TABLE III.—*Results secured with four lots of pigs on irrigated alfalfa pasture without supplementary feed on the Scottsbluff Experiment Farm and the Tieton Reclamation Project in 1914, 1915, and 1916.*

Pigs.	Location.	Time.	Number of pigs.	Average initial weight.	Area of pasture.	Time of test.	Gain (pounds).			Average carrying capacity per acre.
							Total per acre.	Per acre per day.	Per pig per day.	
				Lbs.	*Acres.*	*Days.*				*Lbs.*
Lot 1	Scottsbluff	Summer, 1914	6	59	0.25	90	408	4.53	0.19	1,620
Lot 2	do	Spring, 1915	3	108	.25	60	308	5.10	.43	1,450
Lot 3	do	Summer, 1915	6	33	.25	90	304	3.40	.14	944
Lots 2 and 3	do	All season, 1915	.....	.....	.25	150	612	4.10	.....	.....
Lot 4	Tieton project.	Summer, 1916	60	35	18.00	63	.....	.....	.30	.....

The pigs in lot 4 had access to 18 acres of alfalfa, much more than they could consume, so that the only significant figure secured with this lot was the average daily gain per pig, which amounted to 0.3 pound during the 60-day period. In lots 1, 2, and 3 the average daily gains were all low, considering the sizes of the pigs; and, as will be seen later, the gains per acre and the carrying capacity were lower than those which are secured when the pasture is supplemented with grain.

While the tests which have been conducted show that the best utilization of alfalfa pasture for hogs can not be secured without the use of some supplementary feed, irrigation farmers still pasture hogs in large numbers on alfalfa without supplements. It is true that hogs can be maintained in this way for some time, and that they frequently continue to make small gains for rather long periods. Continued pasturing without supplements, however, prevents good development, makes a hog pot-bellied and renders him incapable of making the most efficient use of concentrated feed later when he is being finished for market. Much of the disappointment experienced by irrigation farmers in finishing hogs for market is due to unthriftiness in the hogs resulting from inadequate previous feeding. The fact that hogs on alfalfa pasture alone will make some growth and that for some time they may not show any signs of serious nutritional deficiency is likely to be very misleading. The serious effects of such feeding are not always noticeable until the finishing period, when it is too late to remedy any defects which may appear.

The practice of pasturing alfalfa without supplements should be avoided whenever possible. On the other hand, if a farmer finds it impossible for a time to obtain any supplementary feed, this fact should not cause him to go out of the hog business. If no grain feed or other supplement is obtainable for a few weeks, the hogs can be

carried on alfalfa pasture alone. Before resorting to this, however, the farmer should make every possible effort to obtain enough grain for a light supplementary ration, or, failing in this, he can often use such a feed as potatoes, as is pointed out later.

PASTURING ALFALFA SUPPLEMENTED WITH CORN.

In practically all the experiments with hogs on alfalfa pasture which are considered in this bulletin, the hogs have received some supplementary feed. The feeds most commonly used by irrigation farmers for this purpose are corn, barley, and, in the Southwest, grain sorghums; but wheat, shorts, and some other supplements have been fed in some instances. Where plenty of corn is available, it is

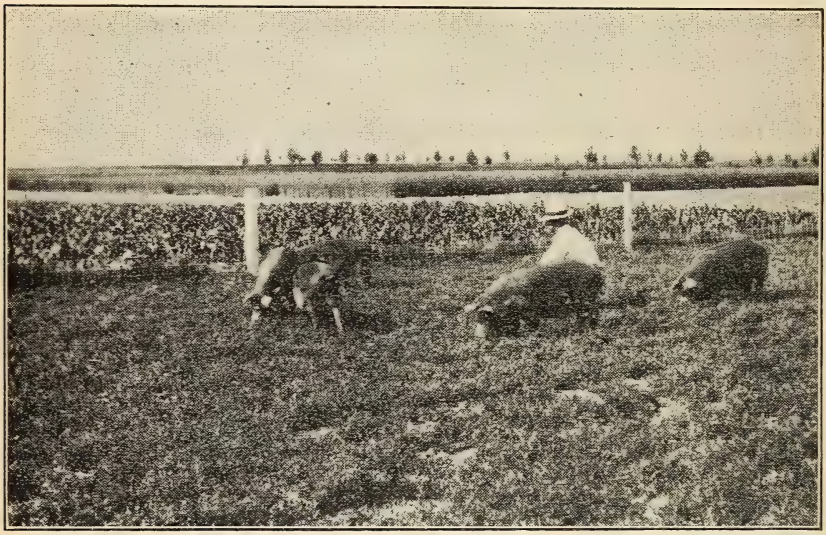

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FIG. 2.—A lot of fall shotes on alfalfa pasture on the Scottsbluff Experiment Farm in June, 1913. The pasture was divided into two parts, which were grazed alternately. These five shotes grazed one-quarter acre of alfalfa to its carrying capacity for 61 days and gained at the rate of 1,500 pounds per acre during this period. The supplementary grain requirement was 275 pounds per 100 pounds of gain.

used extensively, and the quantities fed vary widely. In most of the experiments here reported the daily ration has been about 2 pounds of corn per 100 pounds of live weight of pigs, or, in other words, a "2 per cent" ration. Data on this subject have been secured at three of the Western Irrigation Agriculture experiment farms and in cooperation with farmers on three reclamation projects. These data are presented below.

Experiments at the Scottsbluff Experiment Farm.—Data obtained at Scottsbluff from 1913 to 1916, inclusive, with 17 lots of pigs have been tabulated. In these experiments fall pigs were used during the spring periods, which usually extended through May and June, and

spring pigs were pastured on the same land during the summer periods, from about July 1 to the end of the growing season in September. Each pasture was divided into two parts, which were pastured alternately, one part being grazed while the other was irrigated and the alfalfa on it allowed to produce new growth. The pigs had access most of the time to salt, slack coal, and rock phosphate and were given the care which is usually necessary in successful swine feeding. A lot of 5 hogs on alfalfa pasture in an experiment at Scottsbluff is shown in figure 2. The results secured with these 17 lots of pigs are summarized in Table IV.

TABLE IV.—*Results secured with 17 lots of pigs on irrigated alfalfa pasture supplemented with corn on the Scottsbluff Experiment Farm during the 4-year period from 1913 to 1916.*

Pigs.	Time.	Corn ration.	Number of pigs.	Average initial weight.	Area of pasture.	Time of test.	Gain (pounds).			Average carrying capacity per acre.	Grain fed per 100 pounds of gain.
							Total per acre.	Per acre per day.	Per pig per day.		
		P. ct.		*Lbs.*	*Acres.*	*Days.*				*Lbs.*	*Pounds.*
Lot 1	Summer, 1914	1.10	8	64	0.25	90	1,008	11	0.35	2,568	196
Lot 2	Spring, 1915	1.00	3	108	.25	60	620	10	.45	2,040	215
Lot 3	Summer, 1915	1.00	9	33	.25	90	836	9	.30	1,602	170
Lots 2 and 3	All season, 1915.	1.00			.25	150	1,456	9			189
Lot 4	Spring, 1913	2.30	5	109	.25	61	1,524	25	1.25	2,938	275
Lot 5	Summer, 1913	2.30	12	34	.25	76	2,428	32	.67	2,862	209
Lots 4 and 5	All season, 1913.	2.30			.25	137	3,952	29			234
Lot 6	Summer, 1914	2.06	10	59	.25	90	1,900	21	.53	3,806	244
Lot 7	do	2.64	11	70	.25	90	2,940	33	.74	4,554	299
Lot 8	Spring, 1915	2.00	5	108	.25	60	1,244	20	1	2,782	276
Lot 9	Summer, 1915	2.00	12	31	.25	90	1,732	19	.40	2,454	200
Lots 8 and 9	All season, 1915.	2.00			.25	150	2,976	19			253
Lot 10	Spring, 1915	2.00	5	108	.25	60	1,180	20	1	2,754	274
Lot 11	Summer, 1915	2.00	12	34	.25	90	1,580	18	.38	2,406	226
Lots 10 and 11	All season, 1915.	2.00			.25	150	2,760	19			246
Lot 12	Spring, 1916	2.26	6	83	.25	60	1,440	24	1	2,724	235
Lot 13	Summer, 1916	2.00	10	45	.25	82	1,788	22	.55	2,678	224
Lots 12 and 13	All season, 1916.				.25	142	3,228	23			228
Lot 14	Spring, 1916	2.26	20	74	1	60	1,147	19	.95	2,054	247
Lot 15	Summer, 1916	2.70	40	30	1	97	1,995	22	.55	2,189	289
Lots 14 and 15	All season, 1916.				1	157	3,142	20			274
Lot 16	Spring, 1915	3.00	6	108	.25	60	1,772	30	1.25	3,478	321
Lot 17	Summer, 1915	3.00	15	33	.25	90	2,520	28	.47	3,244	256
Lots 16 and 17	All season, 1915.	3.00			.25	150	4,292	28			283

The data shown in Table IV were secured with 189 pigs in 17 lots, of which 7 contained a total of 50 fall-farrowed pigs, and 10 a total of 139 spring-farrowed pigs. The gains per acre of alfalfa ranged from 9 to 33 pounds per day; the average carrying capacity varied

from 1,602 to 4,554 pounds per acre, and the grain fed for each 100 pounds of gain ranged from 170 to 321 pounds. These data will be further discussed later.

Experiments at the Huntley Experiment Farm.—The results obtained with pigs on alfalfa pasture at Huntley from 1913 to 1916, inclusive, are summarized in Table V. There were in all 7 lots. Each lot had access to one-quarter of an acre of alfalfa and was fed a 2 per cent supplementary ration of corn. The same general methods were followed as for Scottsbluff, already described.

TABLE V.—*Results secured with seven lots of pigs on irrigated alfalfa pasture supplemented with a 2 per cent ration of corn on the Huntley Experiment Farm during the 4-year period from 1913 to 1916.*

Pigs.	Time.	Number of pigs.	Average initial weight.	Time of test.	Gain (pounds).			Average carrying capacity per acre.	Grain fed per 100 pounds of gain.
					Total per acre.	Per acre per day.	Per pig per day.		
			Pounds.	*Days.*				*Pounds.*	*Pounds.*
Lot 1	Summer, 1913	12	60	30	744	25	0.50	3,452	301
Lot 2	Spring, 1914	4	113	70	1,012	14	.90	2,206	323
Lot 3	Summer, 1914	9	41	69	1,292	19	.52	2,114	223
Lots 2 and 3	All season, 1914	.....	.....	139	2,304	16	.....	.....	278
Lot 4	Spring, 1915	5	158	80	1,256	17	.86	3,784	414
Lot 5	Summer, 1915	8	38	70	1,220	18	.54	1,818	212
Lots 4 and 5	All season, 1915	.....	.....	150	2,476	17	.....	.....	313
Lot 6	Spring, 1916	5	105	75	1,620	22	1.08	2,906	260
Lot 7	Summer, 1916	8	44	70	1,412	20	.63	2,130	197
Lots 6 and 7	All season, 1916	.....	.....	145	3,032	21	.....	.....	228

The 7 lots used at Huntley contained a total of 37 spring-farrowed pigs in 4 lots and 14 fall-farrowed pigs in 3 lots. The gains per acre of alfalfa ranged from 14 to 25 pounds per day; the average carrying capacity varied from 1,818 to 3,784 pounds per acre, and the grain fed per 100 pounds of gain ranged from 197 to 414 pounds.

Experiments at the Belle Fourche Experiment Farm.—The results secured with 10 lots of pigs are available from Belle Fourche. Each lot had access to one-fourth of an acre of alfalfa and received a 2 per cent supplementary ration of corn. Each pasture was divided into two equal parts, which were grazed alternately, as at Scottsbluff and Huntley, and the methods used were essentially the same as those employed at the other two stations. The results are summarized in Table VI.

At Belle Fourche were 6 lots of spring-farrowed pigs, a total of 43, and 4 lots of fall-farrowed pigs, a total of 16, or 59 in the 10 lots. The gains per acre of alfalfa varied from 12 to 19 pounds per day,

the average carrying capacity from 1,434 to 2,720 pounds per acre, and the grain fed per 100 pounds of gain from 200 to 292 pounds.

TABLE VI.—*Results secured with 10 lots of pigs on irrigated alfalfa pasture supplemented with a 2 per cent ration of corn on the Belle Fourche Experiment Farm in 1914, 1915, and 1916.*

Pigs.	Time.	Number of pigs.	Average initial weight.	Time of test.	Gain (pounds).			Average carrying capacity per acre.	Grain fed per 100 pounds of gain.
					Total per acre.	Per acre per day.	Per pig per day.		
			Pounds.	*Days.*				*Pounds.*	*Pounds.*
Lot 1	Summer, 1914	5	88	121	1,830	15	0.75	2,720	278
Lot 2	Spring, 1915	4	125	61	938	15	.93	2,046	275
Lot 3	Summer, 1915	7	36	71	1,088	15	.53	1,434	203
Lots 2 and 3	All season, 1915	.....	.....	132	2,026	15	.....	.....	236
Lot 4	Spring, 1915	4	119	61	1,064	17	1.06	2,300	254
Lot 5	Summer, 1915	7	38	71	1,044	15	.54	1,452	214
Lots 4 and 5	All season, 1915	.....	.....	132	2,108	16	.....	.....	234
Lot 6	Spring, 1916	4	102	55	688	12	.75	2,038	270
Lot 7	Summer, 1916	9	60	70	1,274	18	.50	2,348	268
Lots 6 and 7	All season, 1916	.....	.....	125	1,962	16	.....	.....	269
Lot 8	Spring, 1916	4	103	55	658	12	.75	2,058	292
Lot 9	Summer, 1916	8	61	70	1,348	19	.60	2,274	238
Lots 8 and 9	All season, 1916	.....	.....	125	2,006	16	.....	.....	256
Lot 10	Fall, 1915	7	48	36	566	16	.60	1,630	200

Tests made in cooperation with farmers.[1]—The results secured in 10 cooperative tests in which pigs were pastured on alfalfa supplemented with corn are presented in Table VII. In these tests no attempt was made to adjust the number of hogs to the area of alfalfa so as to secure the maximum carrying capacity. The general practice was to allow the pigs to graze at will in alfalfa fields which were also used for hay production, so that the data secured show chiefly the daily gains and the grain consumed per hundredweight of gain. In these tests, furthermore, somewhat higher corn rations were used than in the tests at the experiment farms.

The 10 lots considered in Table VII contained a total of 596 pigs. The average initial weight of these 10 lots ranged from 23 to 175 pounds per head; the pasturing periods varied from 19 to 118 days; the corn rations fed ranged from 1.30 to 6.95 per cent, and the character of the alfalfa fields pastured also varied. The conditions which always influence the grain requirement were, therefore, very diverse.

[1] In the tests made in cooperation with farmers and discussed in this bulletin, the weights of the hogs were secured through the use of a special portable weighing outfit illustrated in fig. 3. The use of this simple outfit greatly facilitated the proper conduct of the tests and by giving exact information regarding the gains made by the hogs materially increased the interest of swine growers in the work.

When the grain rations fed the pigs in these cooperative tests are considered, the results obtained, as indicated by the average daily gain and the grain fed per hundredweight of gain, compare not un-

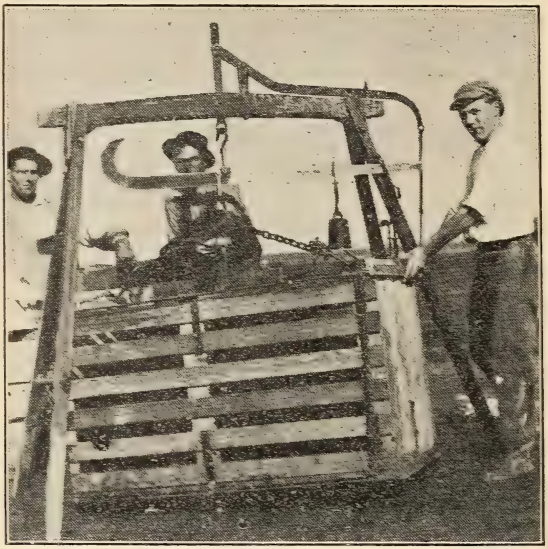

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FIG. 3.—Portable weighing outfit used in the swine-production tests conducted in cooperation with farmers. The crate and the weighing frame are easily taken down and transported from place to place.

favorably with those in the tests made on the experiment farms. It will be noted that increased grain requirement per unit of gain was closely associated with increased size of the grain ration.

TABLE VII.—*Results secured in cooperation with farmers with ten lots of pigs on irrigated alfalfa pasture supplemented with corn on three reclamation projects in 1915 and 1916.*

Pigs.	Project.	Year.	Corn ration.	Number of pigs.	Average initial weight.	Time of test.	Average daily gain per pig.	Grain fed per 100 pounds of gain.
			Per cent.		*Pounds.*	*Days.*	*Pounds.*	*Pounds.*
Lot 1	Uncompahgre	1916	1.30	22	114	33	0.70	228
Lot 2	North Platte	1916	1.86	87	45	31	.40	241
Lot 3	do	1915	2.24	94	23	118	.42	274
Lot 4	do	1915	2.58	64	66	31	.76	263
Lot 5	do	1916	2.62	84	43	31	.48	276
Lot 6	Huntley	1916	3.00	22	66	93	1	332
Lot 7	North Platte	1916	3.31	94	118	68	1.25	415
Lot 8	do	1916	4.87	19	175	27	2.07	478
Lot 9	do	1916	4.90	77	153	36	2.22	414
Lot 10	do	1915	6.95	33	139	19	2.24	494

Summary.—The tests with the 44 lots of pigs on alfalfa pasture supplemented with corn included 895 head. The character of these animals, the quantities of grain fed, the methods of management,

and the lengths of the pasturing period varied greatly. In fact, the diversity was such that the results secured probably indicate approximately the limits within which the returns from this method of utilizing irrigated alfalfa will fall. A summary of certain features of the results secured is given in Table VIII.

TABLE VIII.—*Summary of determinations of gains, carrying capacity, and grain requirement made with 44 lots of pigs on irrigated alfalfa pasture supplemented with corn during the 4-year period from 1913 to 1916, inclusive.*

Item of comparison.	Scotts-bluff.	Huntley.	Belle Fourche.	Coopera-tive tests.	Total.
Number of lots	17	7	10	10	44
Number of pigs	189	51	59	596	895
Gains per acre, for the season (15 double lots), double lots gaining between—					
1,456 and 2,000 pounds....number..	1	.....	1	.....	2
2,001 and 2,500 pounds....do....	.....	2	3	.....	5
2,501 and 3,000 pounds....do....	3	.....	.....	.....	3
3,001 and 3,500 pounds....do....	2	1	.....	.....	3
3,501 and 4,000 pounds....do....	1	.....	.....	.....	1
4,001 and 4,292 pounds....do....	1	.....	.....	.....	1
Gains per acre per day (34 lots), lots gaining—					
Less than 10 pounds....do....	1	.....	.....	.....	1
Between 10 and 20 pounds....do....	7	5	10	.....	22
Between 21 and 30 pounds....do....	7	2	.....	.....	9
More than 30 pounds....do....	2	.....	.....	.....	2
Average carrying capacity, pounds per acre (34 lots), lots carrying—					
Less than 2,000 pounds....number..	1	1	3	.....	5
Between 2,001 and 3,000 pounds....do....	12	4	7	.....	23
More than 3,000 pounds....do....	4	2	.....	.....	6
Grain consumed per 100 pounds of gain (44 lots), lots consuming—					
Less than 200 pounds....number..	2	1	.....	.....	3
200 to 250 pounds....do....	8	2	4	2	16
251 to 300 pounds....do....	6	1	6	3	16
301 to 350 pounds....do....	1	2	.....	1	4
351 to 400 pounds....do....	.....	.....	.....	.....	.....
More than 400 pounds....do....	.....	1	.....	4	5

As shown in Table VIII, 30 lots of pigs were involved in full-season grazing; that is, 15 lots of pigs were used in pasturing alfalfa during the spring period, and the same number of lots were used in the summer period. These are referred to in the table as 15 double lots. The other hogs were pastured for shorter periods. The table shows that the gains per acre for the season ranged from 1,456 to 4,292 pounds. Both these gains were made at Scottsbluff, the lowest with lots 2 and 3, fed a 1 per cent ration of corn, and the highest with lots 16 and 17, fed a 3 per cent ration of corn. Of the 15 double lots, 5 gained from 2,001 to 2,500 pounds per acre, 3 from 2,501 to 3,000 pounds, and 3 from 3,001 to 3,500 pounds per acre. It is reasonable to expect that gains of about 2,500 pounds per acre of alfalfa can be made during the season if the supplementary corn ration is as high as 2 per cent. Variations in the gains will depend on the hogs, the supplementary ration, the crop, and the methods of management.

Of the 34 lots furnishing data on the gains per acre, 22 lots gained from 10 to 20 pounds, and 9 gained from 21 to 30 pounds per acre

per day. There was no consistent significant difference between small pigs and large pigs in this connection. In pasturing alfalfa approximately to its carrying capacity, a daily gain of 15 to 20 pounds per acre would be a conservative estimate if the supplementary corn ration were as high as 2 per cent.

Data on carrying capacity are furnished by 34 lots. With 23 of these the average carrying capacity was between 2,001 and 3,000 pounds per acre for the pasture period. Usually the alfalfa pasture will support a somewhat greater live weight of large pigs than of small ones. The carrying capacity is, of course, higher in midsummer than in spring or early autumn, because of the more rapid growth of the crop in warm weather. In the extreme southwestern section of the country, however, a period of slow growth occurs during the hottest part of the summer. An average carrying capacity of 2,500 pounds per acre would be a safe estimate on which to base alfalfa pasturing enterprises if the pasture were supplemented with as much as a 2 per cent ration of corn. The carrying capacity increases rapidly with increased grain allowance.

Of the 44 lots furnishing data on the grain requirement per hundred pounds of gain, 32 required between 200 and 300 pounds. In general, the grain requirement increased with the size of the hogs and the size of the grain ration. With pigs averaging less than 125 pounds at the beginning of a 60-day to 90-day pasturing period, and fed a supplementary corn ration of about 2 per cent, the grain requirement per hundred pounds of gain should not exceed 300 pounds, and with very favorable conditions it should be as low as 250 pounds.

The rate of gain is influenced by the size and character of the hogs, the abundance of the alfalfa, and the size of the corn ration. The average daily gain per pig in the 44 lots on alfalfa pasture supplemented with corn ranged from 0.30 pound to 2.24 pounds, the latter being secured with a lot of thirty-three 139-pound pigs on pasture for only 19 days and fed a corn ration of 6.95 per cent. Of the 44 lots, 11 made average daily gains ranging from 0.30 to 0.50 pound per pig; 16, from 0.51 to 0.75 pound; 9, from 0.76 to 1 pound, and in the remaining 8 lots the average daily gain per pig ranged from 1.01 to 2.24 pounds. These figures, covering the diversity of conditions in the 44 tests, are of value, as they will apply in a general way to mixed lots of pigs, of which many are pastured by irrigation farmers. With such lots the daily gain per pig on alfalfa pasture supplemented with corn can be expected to average from 0.50 to 1 pound, small pigs and light rations producing the lower gains and large pigs and heavier rations producing the higher gains. Of the 44 lots, 16 had average initial weights of less than 50 pounds per pig. The average daily gains of these 16 lots ranged from 0.30 to 0.67 pound. There were 11

lots having average initial weights between 51 and 100 pounds. The average daily gains of these 11 lots ranged from 0.35 to 1 pound per pig, all but one, which received a 1 per cent corn ration, averaging more than 0.50 pound per pig. The 15 lots with average initial weights between 101 and 150 pounds made average daily gains between 0.45 pound (a lot receiving a 1 per cent ration of corn) and 2.24 pounds. Of these 15 lots, 13 averaged 0.75 pound or more gain per day per pig.

PASTURING ALFALFA SUPPLEMENTED WITH BARLEY.

In many irrigated districts barley is extensively used to supplement alfalfa pasture for hogs. In certain districts having short growing seasons corn production is somewhat hazardous, particularly in the absence of satisfactory corn varieties. In such places barley is commonly the leading grain feed for hogs. Table IX shows the results obtained with 15 lots of pigs on alfalfa pasture supplemented with barley. In practically all these tests rolled barley was used, and about a 2 per cent ration was fed. In general, the same methods of pasturing were used as those described for the tests in which corn was the grain supplement.

As shown in Table IX, there were 6 instances in which alfalfa was pastured for approximately a full season, the length of the pasture period ranging from 125 to 190 days. The gains per acre in these instances ranged from 1,912 to 2,788 pounds, both this minimum and this maximum being gained at the Truckee-Carson Experiment Farm with a 2 per cent ration of barley. These results show the effect of differences in the character of the alfalfa pasture and in the pigs used.

Data on carrying capacity are furnished by 14 lots. The average carrying capacity in these 14 lots ranged from 1,075 to 3,114 pounds per acre. One of the two instances in which the lower carrying capacity was obtained was at the Truckee-Carson Experiment Farm in the fall of the year 1916, and the other was in the summer of 1917 at the Yuma Experiment Farm where, as previously stated, alfalfa has a period of slow growth in the hottest part of the summer. In 8 of the 14 instances considered in Table IX, the carrying capacity was above 2,000 pounds per acre. A gain of 2,500 pounds per acre can reasonably be expected from good alfalfa pasture supplemented with as much as a 2 per cent ration of barley; but, as in the case of corn, the gains will vary widely with differences in the hogs, the pasture, and the methods of management.

Eliminating lot 13, which was pastured for only 14 days, the grain requirement of the lots considered in Table IX ranged from 214 to 334 pounds per 100 pounds of gain. One half the lots consumed 300

pounds or less for each 100 pounds of gain, and the grain consumption of the other half ranged from 313 to 334 pounds per 100 pounds of gain. The rate of gain varied from 0.33 pound per pig per day in lot 3, consisting of 12 pigs weighing 33 pounds each, fed a 2 per cent ration of barley, to 1.21 pounds per pig per day in lot 15, consisting of 64 pigs weighing 89 pounds each, fed a barley ration of 3.68 per cent and having access to a large field of alfalfa.

TABLE IX.—*Results secured with 15 lots of pigs on irrigated alfalfa pasture supplemented with barley on five reclamation projects in 1914, 1915, and 1916.*

Pigs.	Location.	Time.	Barley ration.	Number of pigs.	Average initial weight.	Area of pasture.	Time of test.	Gain (pounds).			Average carrying capacity per acre.	Grain fed per 100 pounds of gain.
								Total per acre.	Per acre per day.	Per pig per day.		
			P. ct.		*Lbs.*	*Acres.*	*Days.*				*Lbs.*	*Lbs.*
Lot 1	Scottsbluff	Summer, 1914.	1.93	10	56	0.25	90	1,740	19	0.48	3,114	243
Lot 2	do	Spring, 1915	2.00	5	108	.25	60	1,180	20	1	2,758	272
Lot 3	do	Summer, 1915.	2.00	12	33	.25	90	1,592	18	.33	2,388	214
Lots 2 and 3	do	All season, 1915.	2.00	....	.....	.25	150	2,772	18	.....	.....	243
Lot 4	do	Spring, 1916	2.52	19	77	1	60	963	16	.84	1,937	300
Lot 5	do	Summer, 1916.	2.50	40	30	1	97	1,738	18	.45	2,060	280
Lots 4 and 5	do	All season, 1916.	2.51	....	.....	1	157	2,701	18	.....	.....	292
Lot 6	Umatilla	Spring, 1914	2.00	4	84	.25	135	1,768	13	.81	2,196	327
Lot 7	do	Summer, 1914.	2.00	4	90	.25	55	524	10	.61	1,682	334
Lots 6 and 7	do	All season, 1914.	2.00	....	.....	.25	190	2,292	12	.....	.....	329
Lot 8	Truckee-Carson.	All season, 1915	2.00	10	39	.25	125	1,912	15	.37	2,516	313
Lot 9	do	Spring, 1916	2.00	17	37	.50	84	1,336	16	.47	1,926	230
Lot 10	do	Summer, 1916.	2.00	10	87	.50	32	484	15	.70	1,986	250
Lot 11	do	Fall, 1916	2.00	6	85	.50	14	110	8	.67	1,075	260
Lots 9, 10, and 11.	do	All season, 1916.	2.00	....	.....	.50	130	1,930	15	.....	.....	236
Lot 12	do	Spring and summer, 1916.	2.00	10	26	.25	138	2,552	18	.46	2,324	246
Lot 13	do	Fall, 1916	2.00	6	94	.25	14	236	17	.69	2,382	140
Lots 12 and 13.	do	All season, 1916.	2.00	....	.....	.25	152	2,788	18	.....	.....	237
Lot 14	Yuma	Summer, 1917.	2.00	12	38	.75	98	878	9	.56	1,075	324
Lot 15	North Platte project.	Summer, 1915.	3.68	64	89	Excess.	32	.....	....	1.21	.....	329

PASTURING ALFALFA SUPPLEMENTED WITH MILO.

Data are available from 3 tests in which a 2 per cent ration of cracked milo was used to supplement alfalfa pasture at the Yuma Experiment Farm. The same general methods of pasturing were practiced as in the pasturing experiments at the other experiment farms, as discussed above. The results secured are summarized in Table X.

TABLE X.—*Results secured with three lots of pigs on irrigated alfalfa pasture supplemented with a 2 per cent ration of cracked milo on the Yuma Experiment Farm in 1916 and 1917.*

Pigs.	Time.	Number of pigs.	Average initial weight.	Area of pasture.	Time of test.	Gain (pounds).			Average carrying capacity per acre.	Grain fed per 100 pounds of gain.
						Total per acre.	Per acre per day.	Per pig per day.		
			Pounds.	*Acres.*	*Days.*				*Pounds.*	*Pounds.*
Lot 1	Spring, 1916	6	59	0.25	56	1,060	19	0.32	1,896	222
Lot 2	Summer, 1916	6	71	.25	126	2,376	19	.80	2,892	243
Lots 1 and 2	All season, 1916			.25	182	3,436	19			237
Lot 3	Spring, 1917	16	58	.75	120	1,868	15	.77	2,168	240

The results obtained with cracked milo as a pasture supplement at Yuma compare very favorably with those secured with corn and barley in similar tests conducted at the other experiment farms.

PASTURING ALFALFA SUPPLEMENTED WITH WHEAT AND SHORTS.

Generally speaking, the use of wheat as a hog feed has not been extensively adopted by irrigation farmers. In some districts, however, wheat has been produced more extensively than barley or corn, and in these districts the crop has been fed to hogs rather commonly. Feeding unmarketable or low-grade wheat to hogs also has been rather widely practiced in some districts, and some use has been made of shorts for the same purpose. The results secured in three tests in which wheat was used as a supplement to alfalfa pasture and in two tests in which shorts were used are summarized in Table XI. Lots 1, 2, and 4 were on the Tieton Reclamation Project, lot 3 on the Uncompahgre Reclamation Project, and lot 5 on the Belle Fourche Experiment Farm. The wheat used was cracked or ground in each instance. The gain per acre of alfalfa pasture was determined in only one case; so this item is omitted from the table.

TABLE XI.—*Results secured with five lots of pigs on irrigated alfalfa pasture supplemented in three instances with wheat and in two instances with shorts on three reclamation projects.*

Pigs.	Supplement.	Grain ration.	Number of pigs.	Average initial weight.	Time of test.	Gain per pig per day.	Grain fed per 100 pounds of gain.
		Per cent.		*Pounds.*	*Days.*	*Pounds.*	*Pounds.*
Lot 1	Wheat	1.00	7	40	49	0.82	99
Lot 2	do	6.40	12	114	24	2.58	319
Lot 3	do	2.00	11	118	30	1.10	256
Lot 4	Shorts	3.80	5	66	62	.96	331
Lot 5	do	2.00	7	48	36	.53	203

With the exception of lot 1, in which the grain requirement per 100 pounds of gain was very low, the results secured with wheat and shorts as supplements to alfalfa pasture were about the same as those secured with corn and barley.

The above figures are valuable merely as a general indication of the gains which can be expected, and, except lot 1, the probable grain requirements per 100 pounds of gain with hogs having access to alfalfa pasture supplemented with the two feeds mentioned. The use of wheat as a hog feed is not looked upon with favor, particularly under war conditions, because of the need of this grain as human food.

PASTURING ALFALFA SUPPLEMENTED WITH POTATOES.

Potatoes are not ordinarily important as a supplement to alfalfa pasture, but occasionally conditions favor their use for this purpose. On those irrigation projects where potatoes are grown commercially it is sometimes impossible to market the crop through the ordinary channels because of ample production in districts nearer to the large consuming centers. At such time large quantities of potatoes produced under irrigation are wasted. This condition prevailed in a few districts in the spring of 1918. At that time efforts were made by the field men of the Office of Demonstrations on Reclamation Projects to promote the use of potatoes in swine feeding.

One feeding enterprise conducted in cooperation with a farmer on the Truckee-Carson Reclamation Project in May and June, 1918, furnishes an example of how potatoes may be used advantageously under the conditions just described. The farmer who owned the pigs was unable to secure any grain to supplement alfalfa pasture, but he was able to buy 13 tons of potatoes at a very low price. The 28 pigs which were pasturing on alfalfa without supplementary feed were weighed 10 days before the potato feeding began, again on that day, and finally 35 days later, when all the potatoes were consumed and the hogs were sold. The potatoes were fed raw and without limit during the 35-day period. The results are shown in Table XII.

These results are considered satisfactory in view of the fact that the pigs were not in a very thrifty condition at the beginning of the potato-feeding period, having been on alfalfa pasture without supplements. From this test it appears that 6 to 8 pounds of raw potatoes are equal to 1 pound of grain in feeding value as a supplement to alfalfa pasture. It is probable that a higher feeding value of potatoes would be indicated by hogs which had been better fed previously. The quality of the pigs and their market value per pound increased materially as a result of the potato feeding, and a fair return was realized from the potatoes, which otherwise would have been wasted. This test suggests one method whereby hogs may

be used advantageously under certain conditions in utilizing potatoes and also whereby the value of alfalfa pasture for hogs may be increased in the absence of the ordinary grain supplements.

TABLE XII.—*Results obtained with one lot of pigs on irrigated alfalfa pasture supplemented with a potato ration on the Truckee-Carson Reclamation Project in 1918.*

Items of comparison.	Alfalfa pasture alone.	Alfalfa pasture and potatoes.
Number of pigs	28	28
Time of test.....days	10	35
Average initial weight per pig.....pounds	137	140
Total gain.....do	77	1,058
Average daily gain per pig.....do	0.24	1.08
Potatoes fed.....do		26,000
Potatoes fed per 100 pounds of gain.....do		2,457

PASTURING ALFALFA SUPPLEMENTED WITH MIXED CONCENTRATES.

It is not an uncommon practice among swine growers on the irrigated lands to feed hogs mixtures of two or more grains or of one grain and some other feed. In this way use is made of swine in utilizing materials which are not readily marketable or which otherwise would be wasted. Table XIII contains data from 13 lots of pigs to which mixed concentrates were fed as supplements to alfalfa pasture. All these lots had an excess of pasture except Nos. 10 and 11, which grazed 1 acre, and Nos. 12 and 13, which had access to 0.4 of an acre of pasture. Lots 1 to 8, inclusive, were on farms on the North Platte Project; lots 9, 10, and 11, on the Uncompahgre Project; and lots 12 and 13, on the Truckee-Carson Experiment Farm.

TABLE XIII.—*Results secured with 13 lots of pigs on irrigated alfalfa pasture supplemented with mixed concentrates on three reclamation projects.*

Pigs.	Supplementary feed.[1]	Ration.	Number of pigs.	Average initial weight.	Time of test.	Gain per pig per day.	Ration fed per 100 pounds of gain.
		Per cent.		*Pounds.*	*Days.*	*Pounds.*	*Pounds.*
Lot 1	Corn 2, shorts 1	3.96	40	34	35	0.72	270
Lot 2	Corn 2, barley 1	2.69	39	58	56	.68	303
Lot 3	Corn 3, spelt 1	2.87	134	47	41	.51	320
Lot 4	Corn 3, wheat 1	4	165	38	41	.62	320
Lot 5	do	6.13	170	50	29	.91	439
Lot 6	Corn 10, wheat 1	4.40	76	45	52	1.08	301
Lot 7	Corn 2, barley 1	1.98	36	48	86	.60	251
Lot 8	Corn 1, oats 2, shorts 2, skim milk 2.	3.30	6	18	137	.94	270
Lot 9	Corn 1, wheat 4½	4.60	31	116	43	1.73	415
Lot 10	Barley 24, tankage 1	3.70	41	86	42	1.43	307
Lot 11	Barley 25, wheat 25, tankage 1	4	41	146	21	1.47	440
Lots 10 and 11					63		350
Lot 12	Barley 3, tankage 1	2	8	67	84	.48	344
Lot 13	Barley 5, tankage 1	3	8	108	21	.77	440
Lots 12 and 13					105		376

[1] The figures following the names of the supplementary feeds indicate the proportions of these feeds in the various mixtures.

The results summarized in Table XIII show the same general facts with reference to supplements for alfalfa pasture as those brought out where the different grain supplements were used separately, as shown in previous tables. The grain consumed per 100 pounds of gain increases with the size of the hogs as well as with the size of the grain ration. The character of the hogs and the pasture is, of course, very important also. It is of interest to note that lots 10 and 11, consisting of 41 pigs fed barley and tankage for 42 days, followed by barley, wheat, and tankage for 21 days, made a gain during the 63-day period of 3,711 pounds on 1 acre of pasture on the Uncompahgre project. These pigs were well bred, had good care, and the alfalfa pasture was in excellent condition. In addition to the alfalfa pasture, the pigs were fed 350 pounds of grain for each 100 pounds of gain. Contrasted with these results are those secured with lots 12 and 13 at the Truckee-Carson Experiment Farm on an inferior stand of alfalfa. In this instance, the gain per acre in 105 days was only 1,144 pounds, and the grain requirement 376 pounds for each 100 pounds of gain.

COMPARISONS OF VARIOUS SUPPLEMENTARY FEEDS FOR ALFALFA PASTURE.

The preceding tables and discussions have been concerned chiefly with showing something of the results which have been secured with various supplementary feeds for alfalfa pasture, without attempting to make comparisons of the values of these supplements. Many of the data which have been obtained in these feeding enterprises are such that direct comparisons can not be made from them. There are, however, a few instances which furnish bases for comparisons, and these will now be considered.

Corn and barley.—Perhaps the most extensive information at present available regarding the comparative value of grain supplements for alfalfa pasture under irrigation is that secured at the Scottsbluff Experiment Farm in 1914, 1915, and 1916 with corn and barley. The results of the comparative tests made during these three years are summarized in Table XIV.

It will be seen from Table XIV that in four of the five comparisons, somewhat less barley than corn was required for 100 pounds of gain. In the exceptional case, a higher ration of barley than of corn was fed, and the alfalfa pasture used by the barley-fed lot was seriously damaged by a sand storm during the pasture season. It is believed that these two factors account for the comparatively unfavorable showing made by the barley in this instance. From these results and from observations in other pasturing enterprises, it is believed that the choice between corn and barley can safely depend on the prices per pound of the two grains, where one or the other is to

be purchased, and on the exigencies of labor and other cultural requirements, where one or the other is to be grown for use as a supplement to alfalfa pasture.

TABLE XIV.—*Summary of results secured in comparative tests with corn and barley as supplements to irrigated alfalfa pasture on the Scottsbluff Experiment Farm in 1914, 1915, and 1916.*

Time and grain used.	Grain ration.	Number of pigs.	Average initial weight.	Area of pasture.	Time of test.	Gain (pounds).		Grain fed per 100 pounds of gain.
						Total per acre.	Per pig per day.	
Summer, 1914:	*Per cent.*		*Pounds.*	*Acres.*	*Days.*			*Pounds.*
Corn	2.06	10	59	0.25	90	1,900	0.53	244
Barley	1.93	10	56	.25	90	1,740	.48	243
Spring, 1915:								
Corn	2	5	108	.25	60	1,244	1	276
Barley	2	5	108	.25	60	1,180	1	272
Summer, 1915:								
Corn	2	12	31	.25	90	1,732	.40	200
Barley	2	12	33	.25	90	1,592	.33	214
Spring, 1916:								
Corn	2.26	20	74	1	60	1,147	.95	247
Barley	2.52	19	77	1	60	963	.84	300
Summer, 1916:								
Corn	2.70	40	30	1	97	1,995	.55	289
Barley	2.50	40	30	1	97	1,738	.45	280

Miscellaneous grains.—There have now been considered 80 lots of hogs pastured on alfalfa supplemented with some kind of grain. Of these 80 lots 44 received corn, 15 received barley, 3 milo, 3 wheat, 2 shorts, and 13 were fed mixed grain rations, each of which contained either corn or barley. The predominance of corn and barley as supplements to alfalfa pastures on irrigated land is thus reflected in the data which have been presented. Other grain feeds are important in certain sections (as, for example, the grain sorghums in the Southwest) and in individual instances in all sections. The data under consideration do not afford comparisons of grains other than corn and barley similar to those made of those two grains in Table XIV. The results secured with milo, as shown in Table X, and with wheat and shorts, as shown in Table XI, furnish no basis for a presumption that these feeds are inferior to corn or barley as supplements to alfalfa pasture. It should be stated, however, that for economic reasons the use of wheat for this purpose is not generally looked upon with favor. The three grains which appear to be best suited for use as alfalfa-pasture supplements in irrigated sections are corn, barley, and the grain sorghums; and, pound for pound, they probably do not differ materially in value for such use. At any rate, it seems certain that any slight differences in feeding value are of decidedly less importance than differences in adaptation to local climatic, economic, and cultural conditions.

ALFALFA PASTURE FOR SOWS AND PIGS.

At the Scottsbluff Experiment Farm in 1914 and 1915, tests were made of alfalfa pasture for sows and their litters. Each lot contained two sows and their litters of spring pigs. Each lot had access to a quarter of an acre of alfalfa divided into two parts, which were pastured alternately for 60 days. The pasture period began on May 4 in 1914 and on April 27 in 1915. One of the lots used in 1914 is illustrated in figure 4. In addition to the pasture the sows and pigs were fed a 2 per cent ration of grain, the pigs being fed grain by themselves. The results are summarized in Table XV.

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FIG. 4.—Two sows and their litters of spring pigs on alfalfa pasture at the Scottsbluff Experiment Farm late in May, 1914. If good alfalfa pasture is supplemented with as much as a 2 per cent ration of corn or barley, an acre will support 6 to 8 sows and 50 to 70 suckling pigs for 60 days. During this time the pigs should gain 25 to 30 pounds each and at the close of the period be ready to go on to alfalfa pasture by themselves.

TABLE XV.—*Results secured with sows and pigs on irrigated alfalfa pasture supplemented with a 2 per cent ration of grain at the Scottsbluff Experiment Farm in 1914 and 1915.*

Sows and pigs.	Grain fed.	Number of—		Average initial weight (pounds).		Gain (pounds).					Average carrying capacity per acre.	Grain fed per 100 pounds of gain.
						Sows.	Pigs.		Sows and pigs.			
		Sows.	Pigs.	Sows.	Pigs.		Total.	Per pig per day.	Per acre.	Per acre per day.		
											Pounds.	*Pounds.*
Lot 1	Corn	2	14	351	12	−99	472	0.56	1,492	25	1,052	315
Lot 2	do	2	15	436	15	−93	491	.54	1,592	26	1,155	276
Lot 3	do	2	15	234	8	−38	423	.47	1,540	26	779	228
Lot 4	Barley	2	17	351	3	−28	446	.44	1,672	28	969	235

On the basis of the results of these tests, an acre of good alfalfa pasture supplemented with a 2 per cent ration of barley or corn would carry 8 sows and from about 50 to 70 suckling spring pigs for a period of 60 days. During this period the pigs should gain an average of 25 to 30 pounds each and be ready at the close of the period to be placed by themselves on alfalfa pasture for the remainder of the summer. Whether results of this character can be obtained will depend on the character of the pigs, the stand and growth of the alfalfa, and the efficiency with which the enterprise is conducted.

EFFECT OF PASTURING ON THE ALFALFA STAND.

It frequently becomes important for a farmer to know something of the effect which hog pasturing has on the stand of alfalfa. Knowledge on this question is useful when plans are being made for pasturing enterprises. At such times it is necessary to select the area to be used and to determine how much land is to be set aside for pasturing.

The intensiveness with which irrigated alfalfa is pastured by hogs ranges from almost negligibly light grazing, in which a small number of hogs are allowed the free run of a large field of alfalfa used primarily for hay production, to the full utilization of the crop by hogs; and beyond this, to extreme overgrazing, in which the grazed area comes to be little more than a dry lot. The very light grazing method may be followed in a field year after year without serious detriment to the stand of alfalfa, but each of the other methods produces marked effects on the stand of the crop. In fields which are grazed approximately to capacity throughout the growing season, the stand is frequently reduced materially in a single year. As the alfalfa plants disappear, weeds, especially grasses, come in, so that the carrying capacity gradually declines. It is seldom profitable to pasture a field to full capacity more than two seasons, and preferably not more than one, as only under unusually favorable conditions will a sufficient alfalfa stand be maintained for a longer time. Overgrazing causes rapid deterioration of the alfalfa stand and soon results in almost complete displacement of the alfalfa plants by weeds or in total lack of plant growth. In fields which are grazed approximately to capacity, the stand of alfalfa can be conserved by practicing sound pasturing methods. The alternate-pasturing method is important in this connection, as it makes it possible to keep the hogs on one pasture while the other is being irrigated, thus preventing the puddling of the soil, which otherwise would occur on all but very light soils. It also allows the plants in each division of the pasture, periods of time at intervals throughout the season in which to recover somewhat from the effects of trampling.

In most cases, the effects of grazing are sufficiently marked to require attention in connection with crop rotation. It is usually desirable to pasture the alfalfa for only one year, or at most two years, before the crop is to be plowed up. In this way efficient utilization of the pasture may be secured, and at the same time the pasturing will be helpful in eradicating the alfalfa in many fields in which the eradication of the crop is a serious problem in crop rotation.

PASTURING SWEET CLOVER.

On the irrigated lands, sweet clover is grown chiefly in fields where alfalfa fails to do well because of seepage or alkali. The species most commonly grown is white sweet clover (*Melilotus alba*). The crop is used chiefly for pasture, to a slight extent for hay, and sometimes it is grown in irrigated districts for its seed, which usually can be marketed in other districts where seed production is more difficult. The crop is not to be regarded as a rival of alfalfa on ordinary irrigated lands, but its ability to grow on certain soils where conditions are unfavorable for alfalfa has resulted in its use on limited areas in irrigated districts.

Two tests of white sweet clover as hog pasture have been made at the Truckee-Carson Experiment Farm. In 1916 a field of 1.25 acres was pastured for a short period (18 days) by 18 pigs, weighing 33 pounds each, which, in addition to the sweet clover, had a 2 per cent supplementary ration of barley. In 1917 nine pigs with an average initial weight of 59 pounds were pastured on a 0.5-acre field for 105 days. For the first 84 days the pigs had a 2 per cent ration of 3 parts barley and 1 part tankage, and during the remaining 21 days a 3 per cent ration of 5 parts barley and 1 part tankage. The results are shown in Table XVI.

TABLE XVI.—*Results secured with pigs on irrigated sweet-clover pasture at the Truckee-Carson Experiment Farm in 1916 and 1917.*

Supplementary feed.	Ration.	Number of pigs.	Average initial weight.	Time of test.	Gain (pounds).			Average carrying capacity per acre.	Ration fed per 100 pounds of gain.
					Per acre.	Per acre per day.	Per pig per day.		
	Per ct.		*Pounds.*	*Days.*				*Pounds.*	*Pounds.*
Barley	2	18	33	18	46	2.5	0.18	420	390
Barley 3, tankage 1	2	9	59	84	754	9	.50	1,431	308
Barley 5, tankage 1	3	9	100	21	238	11	.63	1,927	500

In 1916, when the sweet clover was supplemented with barley, the pigs made very poor gains, although there was an abundance of clover and the pigs ate it readily. Because of the poor gains made, the test was discontinued at the end of an 18-day period, when the

pigs were transferred to alfalfa pasture. In 1917, when tankage was added to barley in the supplementary ration, the results were somewhat better for the first 84 days, but, during the last 21 days the gains were unduly expensive, 500 pounds of supplementary feed being required for each 100 pounds of gain. The results obtained in these tests should not be regarded as conclusively unfavorable to sweet clover as hog pasture. Further trials need to be made of the crop for this purpose. Pending the making of such trials, sweet clover is likely to continue to be considered inferior to alfalfa as a forage crop for hogs and to be regarded as valuable chiefly on soils where alfalfa does not do well.

HOGGING OFF CROPS.

In several swine-producing districts of the country there is a growing practice of turning hogs into fields of corn or other crops

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FIG. 5.—View of a cornfield on an irrigated farm near the close of the hogging period in late autumn. Hogging has proved to be a satisfactory method of utilizing corn crops on irrigated lands, as it saves the labor of harvesting and feeding the crop, produces gains on the hogs economically, and leaves the manure on the land.

at about the time the crops are mature and allowing the hogs to do the harvesting. This practice is becoming common on irrigated farms in connection with corn, and is followed in a limited way with other crops. Three important points in favor of hogging off mature crops are (1) the saving of labor necessary to harvest and feed the crop products, (2) the prompt application of the manure to the land, and (3) the healthful and sanitary conditions of feeding.

During the past six years some data have been secured from tests of hogging off certain of these irrigated crops. A summary of the results follows.

CORN.

In some of the tests here reported the corn has been hogged off without any supplementary feed being used with the corn. In others, the corn was supplemented in various ways. The hogs usually were turned into the cornfields at about the time the corn was well dented. They remained there for varying lengths of time, depending on the size of the field, the number and size of the hogs, and the quantity of feed available. Usually the period ranged from 20 to 40 days, but sometimes it was 60 days or longer. A view of a field in which hogging was continued into the late autumn is shown in figure 5.

Hogging corn without supplementary feed.—The results secured with 23 lots of hogs which harvested corn without supplementary feed have been tabulated. These tests were made at the Scottsbluff, Huntley, and Belle Fourche Experiment Farms, and in cooperation with farmers on the North Platte and Huntley Reclamation Projects. The results are shown in Table XVII.

TABLE XVII.—*Results secured by hogging corn without supplementary feeds on four reclamation projects during the 5-year period from 1912 to 1916, inclusive.*

Location and lot of hogs.	Year.	Number of pigs.	Average initial weight.	Area of field.	Time of test.	Gain (pounds).			Estimated—[1]	
						Total per acre.	Per acre per day.	Per pig per day.	Yield per acre.	Corn consumed per 100 pounds of gain.
Scottsbluff:			*Pounds.*	*Acres.*	*Days.*				*Bushels.*	*Pounds.*
Lot 1	1912	7	117	0.25	16	628	39	1.40	56	499
Lot 2	1913	6	91	.25	28	1,012	36	1.50	83	460
Lot 3	1914	4	63	.25	49	1,048	21	1.31	82	438
Lot 4	1914	3	89	.33	77	810	10	1.17	70	496
Lot 5	1914	3	89	.33	77	1,020	13	1.44	81	444
Lot 6	1915	3	75	.25	19	212	11	.91	26	687
Lot 7	1915	3	80	.33	55	666	12	1.34	.....	.....
Lot 8	1915	3	68	.33	55	483	9	1	.....	.....
Lot 9	1916	5	94	.25	23	840	37	1.85	67	446
Huntley:										
Lot 10	1913	4	84	.25	23	768	33	2.06	60	437
Lot 11	1914	4	86	.25	22	896	41	2.56	50	324
Lot 12	1915	4	86	.25	25	864	34	2.16	52	340
Lot 13	1916	4	95	.25	20	672	34	2.10	60	500
Belle Fourche:										
Lot 14	1912	2	85	.25	26	340	13	1.62	29	477
Lot 15	1913	8	51	.25	11	560	51	1.60	34	340
Lot 16	1914	4	107	.25	20	582	29	1.80	35	337
Lot 17	1915	5	81	.25	15	548	36	1.80	40	409
Lot 18	1915	12	62	.50	10	451	45	1.87	34	422
Lot 19	1916	3	104	.25	24	518	21	1.80	59	638
Lot 20	1916	3	100	.25	24	350	14	1.29	45	750
Lot 21	1916	3	112	.25	27	562	21	1.86	50	498
North Platte project:										
Lot 22	1915	38	152	3.60	25	580	23	2.19	57	548
Huntley project:										
Lot 23	1915	67	100	13.40	27	183	7	1.40	14	435

[1] Fractions are omitted from figures showing estimated yields but are included in the calculations of the corn consumed per 100 pounds of gain.

The data shown in Table XVII involved 198 hogs and about 23 acres of corn. It will be observed that most of the fields were small,

21 of the 23 containing less than 1 acre each. In average initial weight, the pigs used ranged from 51 to 152 pounds, but 18 of the 23 lots averaged 80 pounds or more per pig. Seven of the lots averaged 100 pounds or more per pig. The length of the hogging period ranged from 10 to 77 days, about half being between 20 and 30 days. The gains per acre varied widely, of course, because of the variations in the yield of corn and the character of the hogs used. The range in gain per acre was from 183 to 1,048 pounds. The gains per acre per day depend chiefly on the yield of corn and the number of hogs per acre, but they are influenced also by the size and thriftiness of the hogs. The animals all made fairly rapid gains, as would be expected of hogs having free access to cornfields.

The yield estimates for lots 1 to 21, inclusive, were made in one of two ways. In some cases the yield of the hogged plat was assumed to equal the average yield of several other plats in the same field with the same cultural treatment. In the other instances the yield of 100 stalks systematically selected in the quarter-acre or half-acre plat was actually determined, and the average yield per stalk so determined was multiplied by the total number of stalks on the plat. These two methods of estimating probably gave results which were within 10 per cent of the actual yields, but the figures should be regarded merely as approximations. The yield estimates in lots 22 and 23 mere made by the farmers owning the fields.

On the basis of these estimates, the corn consumed per 100 pounds of gain ranged from 324 pounds (5.8 bushels), in lot 11 at the Huntley Experiment Farm, to 750 pounds (13.4 bushels), in lot 20 at the Belle Fourche Experiment Farm. In only 5 out of the 21 cases for which estimates were made did the corn consumed equal or exceed 500 pounds per 100 pounds of gain; and in only four cases was it less than 400 pounds. The average for the 12 lots consuming between 400 and 500 pounds of corn per 100 pounds of gain was about 450 pounds, or 8 bushels. This probably is a fair approximation of what should be expected when hogs weighing 75 to 125 pounds are used to hog off the corn without supplementary feed.

Hogging corn with supplementary feed.—The supplements used in the corn-hogging tests considered here include tankage, alfalfa pasture, rape, and the aftermath in alfalfa and grain fields. Data from 14 lots are available and are summarized in Table XVIII. These lots were distributed as follows:

Lots 1, 2, 3, 4, 7, 8, 9, and 10 at the Scottsbluff Experiment Farm.
Lots 5 and 6 on a small farm on the Tieton Reclamation Project.
Lot 11 on the North Platte Reclamation Project.
Lot 12 on the Huntley Reclamation Project.
Lot 13 on the Huntley Experiment Farm.
Lot 14 on the Boise Reclamation Project.

TABLE XVIII.—*Results secured by hogging corn with supplementary feeds on four reclamation projects for the 4-year period from 1914 to 1917, inclusive.*

Hogs.	Year.	Supplementary feed.	Number of pigs.	Average initial weight.	Area of field.	Time of test.	Grain (pounds).			Estimated—	
							Total per acre.	Per acre per day.	Per pig per day.	Yield per acre.	Corn consumed per 100 pounds of gain.
				Pounds.	*Acres.*	*Days.*				*Bushels.*	*Pounds.*
Lot 1	1914	100 pounds tankage.	3	88	0.33	77	1,377	18	2	87	354
Lot 2	1914	do	3	90	.33	77	1,308	17	1.90	88	377
Lot 3	1915	do	3	74	.33	55	606	11	1.22	.....	.....
Lot 4	1915	do	3	72	.33	55	822	15	1.66	.....	.....
Lot 5	1916	500 pounds tankage.	60	91	9.40	44	709	16	2.52	.....	.....
Lot 6	1917	200 pounds tankage.	50	106	6.96	46	733	16	2.22	56	428
Lot 7	1914	Late alfalfa pasture	3	91	.33	77	1,116	14	1.60	81	406
Lot 8	1914	do	3	89	.33	77	1,117	15	1.66	88	420
Lot 9	1915	do	3	78	.33	55	723	13	1.46	.....	.....
Lot 10	1915	do	3	69	.33	55	699	13	1.41	.....	.....
Lot 11	1916	do	133	68	47.50	97	335	3	1.34	.....	.....
Lot 12	1916	do	151	124	15.20	21	391	19	1.87	27	394
Lot 13	1916	Rape	4	82	.50	38	586	16	2	50	485
Lot 14	1915	Aftermath of alfalfa, peas, and wheat.	28	117	1	30	589	19	.70	.....	.....

The figures shown in Table XVIII involved 450 hogs and 83.2 acres of corn. Only four of the fields contained more than 1 acre each, so that 10 of the lots were small. The average initial weight of the hogs in the 14 lots ranged from 68 to 124 pounds, only three lots having average initial weights as high as 100 pounds per pig. The length of the hogging period ranged from 21 to 97 days. With 10 of the 14 lots this period ranged from 44 to 77 days. The gains per acre ranged from 335 to 1,377 pounds, depending chiefly on the yield of corn and the character of the hogs used. The average daily gain in all but five cases exceeded 1.5 pounds per pig. On the basis of the estimated yields in the seven cases in which estimates are available, the corn consumed per 100 pounds of gain ranged from 354 pounds (6.3 bushels) in lot 1 to 485 pounds (8.7 bushels) in lot 13. The average for these seven lots is 409 pounds. This is somewhat lower than the corresponding figure (450 pounds) indicated as an approximation for the lots hogging corn without supplements.

There appears to be no doubt that supplements reduce the corn requirement. Just how great this reduction is can not be definitely determined from the figures given in Tables XVII and XVIII, but valuable indications with reference to alfalfa pasture and tankage as supplements may be found by comparing the results secured at the Scottsbluff Experiment Farm with the six duplicate lots of three hogs each which were used in the experiments in 1914 and 1915. This comparison is shown in Table XIX, in which the average results of the trials for two years are presented.

TABLE XIX.—*Results secured by hogging corn with supplementary feeds on the Scottsbluff Experiment Farm in 1914 and 1915.*

Items of comparison.	Supplementary feeds.		
	None.	Alfalfa pasture.	Tankage.
Lots of hogs.....number..	4	4	4
Hogs per acre in each lot.....do....	9	9	9
Length of hogging period.....days..	66	66	66
Average initial weight per hog.....pounds..	82	82	81
Total gain per acre.....do....	744	930	1,029
Average daily gain per hog.....do....	1.25	1.57	1.73
Estimate of corn consumed per 100 pounds of gain.....do....	524	446	405
Tankage consumed per 100 pounds of gain.....do....	.....	.....	29

It will be seen that the lots which received supplementary feed made more rapid gains and consumed less corn per unit of gain than those which received no supplements. Holden,[1] who first reported the results of this experiment, concluded that with the usual price for tankage, the use of that material as a supplement to hogged-off corn would be better than not to use any supplement, but that where the hogs could have access to alfalfa pasture it was doubtful whether it would pay to feed tankage. In any event the desirability of giving the hogs access to alfalfa pasture is apparent. At the time of year when corn is hogged off in irrigated districts, the growth of alfalfa is relatively slow, so that the small quantity of alfalfa which the hogs eat would otherwise be wasted in most instances.

At the Huntley Experiment Farm, where rape, grown with the corn, has been tested as a supplement to hogged-off corn, no material effect on the rate or amount of gains has been observed. This might not be the case in sections where rape produces a heavy growth. It seems likely that in most irrigated sections access to an alfalfa field during the corn-hogging period will furnish a satisfactory supplementary feed for the hogs, particularly in view of the inexpensiveness of this supplement.

FIELD PEAS.

Field peas have not been widely adopted as a hog feed on irrigated lands generally. The use of the crop for this purpose, however, has been sufficiently successful on individual farms in a large number of districts to indicate the high value of the crop as hog feed. Most of the difficulties encountered in attempts to use field peas in swine feeding have been production difficulties. As will be indicated later, widely varying results have been secured from hogging off peas in different fields in a single locality. These variations reflect the wide differences in the yields obtained by different farmers. The success-

[1] Holden, J. A. Experiment in disposal of irrigated crops through the use of hogs. Dept. Agr. Bul. 488, 25 p., 3 fig. 1917.

ful production of field peas requires a wise selection of a variety from a very large number and careful attention to the cultural requirements of the crop. The crop undoubtedly is adapted to the conditions in most irrigated districts, except, perhaps, those in the Southwest, where high summer temperatures prevail. The present indications are that, as farmers learn to grow the crop successfully, its use as hog feed will be widely adopted.

Data are available from 18 of these tests in which field peas were hogged off. In eight of these tests the peas were grown without additional grain. In six tests the peas were grown with wheat. Peas were mixed with oats in one case and with barley in three cases. In

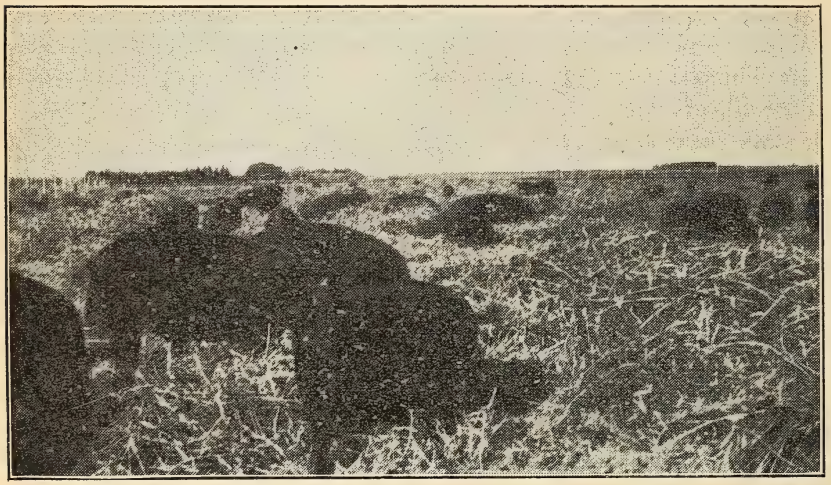

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FIG. 6.—A field of peas being pastured off by hogs on an irrigated farm. This field contained 4.6 acres, and 97 shotes gained at the rate of 843 pounds per acre in 37 days.

12 of the 18 tests no supplementary feed was given. In the remaining instances the pigs had access to alfalfa from which usually the season's hay crops had been harvested. The time of turning the pigs into the field in these tests ranged from late July to mid-September. The pigs may be turned in as soon as the peas show signs of ripening. The duration of the hogging period will depend on the time required to clean up the crop. This depends on the size of the crop and the age and number of the pigs. In these tests the hogging period ranged from 12 to 68 days. A view of one lot of pigs (lot 15 in Table XX) in a field of peas is shown in figure 6.

The very wide diversity in the results secured was due largely to the variation in the size of the crops hogged off. The tests were all conducted on practical farms in cooperation with their owners on five reclamation projects. The results are presented in Table XX.

TABLE XX.—*Results secured by hogging off field peas when grown alone and with other grain crops on five reclamation projects in 1915, 1916, and 1917.*

Pigs.	Project.	Year.	Other grain.	Supplementary feed.	Number of pigs.	Average initial weight.	Area of field.	Time of test.	Gain (pounds).		
									Total per acre.	Per acre per day.	Per pig per day.
						Pounds.	*Acres.*	*Days.*			
Lot 1	Tieton	1915	None	None	67	45	2.20	32	672	21	0.69
Lot 2	Minidoka	1917	do	do	39	113	3.40	55	949	17	1.50
Lot 3	do	1917	do	do	38	94	3.63	68	808	12	1.13
Lot 4	Boise	1917	do	do	33	80	1.50	17	250	15	.66
Lot 5	do	1916	Wheat	do	138	32	5.20	36	915	25	.96
Lot 6	do	1916	do	do	128	68	9	41	515	13	.90
Lot 7	Truckee-Carson	1916	do	do	34	63	1.25	21	760	36	1.40
Lot 8	Boise	1917	do	do	33	91	1.50	14	286	20	.93
Lot 9	do	1917	Oats	do	26	92	.....	18	.....	.....	1.40
Lot 10	do	1916	Barley	do	20	118	1	43	650	15	.75
Lot 11	Tieton	1916	do	do	60	54	3.10	40	716	18	.92
Lot 12	do	1917	do	do	48	63	4.40	37	371	10	.92
Lot 13	Huntley	1915	None	Alfalfa pasture.	66	63	1.90	12	479	40	1.02
Lot 14	Boise	1915	do	do	28	75	1	25	425	17	.61
Lot 15	Minidoka	1915	do	do	97	71	4.60	37	843	23	1.08
Lot 16	Boise	1916	do	do[1]	33	69	2	31	277	9	.54
Lot 17	do	1915	Wheat	do	28	91	1	25	746	30	1.06
Lot 18	do	1916	do	do	33	86	1	17	447	26	.80

[1] Plus 350 pounds of barley and 600 pounds of milk.

Table XX shows the results of 18 tests involving a total of 949 pigs and a total area of about 50 acres. The number of pigs per lot ranged from 20 to 138, and the fields ranged in size from 1 acre to 9 acres. The gains per acre varied from 250 to 949 pounds. The average gain per acre of the 17 lots for which this was determined was a little less than 600 pounds. Of the eight tests in which the gains per acre were less than 600 pounds, six were on the Boise project; but some of the best gains were made on the same project. These facts indicate the wide variation to be expected in any given locality, depending upon the size of the pea crop in each field. The average daily gain per pig ranged from 0.54 pounds to 1.50 pounds. These gains naturally depend upon the abundance of the feed and the character of the pigs used. While the gains per acre of peas are not strictly comparable with those secured by hogging corn, because of differences in the location of the tests, it is of interest to observe that the ranges in gains per acre of the two crops were not widely different. The range with corn without supplementary feeds was from 183 to 1,048 pounds per acre, while that with peas was from 250 to 949 pounds per acre.

The conditions under which these tests were conducted made it impossible to determine the values of supplementary feeds and the advantages of growing some small grain with the peas. There is nothing in these data to show whether or not a grain mixture or a supplementary feed is advantageous. This is a question which should

be thoroughly investigated under irrigation. It was impracticable in the tests reported above to determine the quantity of peas or of peas and other grains required to produce a pound of gain. There is need for experimentation in this connection also.

Speaking generally, it appears that where field peas do well under irrigation their use as a crop to be hogged off should be much more extensive than it is at present. The crop is particularly valuable at times when the commoner grain feeds are high priced, and its utilization by swine growers on irrigated lands offers many excellent opportunities.

HORSE BEANS.

Horse beans have not been tried extensively by irrigation farmers in this country, but in one or two sections, particularly in the Snake River valley of Idaho, the crop has become of some importance. In 1915 plantings of horse beans were made at the Scottsbluff, Huntley, and Belle Fourche Field Stations, with seed produced at Gooding, Idaho. The results were unsatisfactory, as shown by the following report made by the superintendent of the Huntley Field Station on the behavior of the crop at that point, where the results were typical of those secured at Scottsbluff and Belle Fourche:

> A test of horse beans was made in 1916 on a one-eighth acre plat in field A–I. Seeding was done in the latter part of April. The seed was planted closely in rows 20 inches apart. A good stand was secured and the crop made a very good growth up to the time of blooming, which was about August 1. It was attacked at this time by a disease which practically stopped the growth of the plants. In many instances the plants were killed. On a few of the plants a small amount of seed formed. This seed was badly shrunken, as were also the foliage and stems. Only a few of the plants remained alive at the end of the season, and the amount of seed was so small and the quality so poor that the crop was not harvested.

Welch reports[1] as follows regarding horse beans on irrigated lands in Idaho:

> Horse beans (*Vicia faba*), or Broad Windsor beans, are extensively grown in some parts of irrigated Idaho. They are grown almost exclusively for "hogging-off" purposes. During the season of 1915 a crop was grown on the station farm for the purpose of finding its relative value when compared with field peas used in the same way. The horse beans were sown a little too late to secure maximum growth. They are considered somewhat inferior to field peas when used for pork production.

A few farmers in Idaho have reported very satisfactory results from hogging off horse beans. Others have attempted to use the crop for this purpose but without success. It appears that the plants are specially susceptible to the attacks of certain fungous diseases, as was indicated in the test at Huntley. In view of the knowledge at pres-

[1] Welch, J. S. Experiments with legume crops under irrigation. Idaho Exp. Sta. Bul. 94, 14 p., 4 fig. 1917.

ent available, the crop is to be regarded as in the experimental stage, and attempts to grow it for hogging-off purposes should be made conservatively.

GRAIN SORGHUMS.

Although certain of the grain sorghums are hogged off in the irrigated sections of the Southwest, there are but few experimental data regarding the practice. The high value of one of the grain sorghums (milo) as a supplement to alfalfa pasture for hogs already has been pointed out, but only fragmentary evidence is available regarding the practice of hogging off the crop.

In 1916 at the Yuma Field Station, 12 hogs with an average initial weight of 170 pounds were pastured on a half-acre field of milo for 21 days, at the same time having access to a small patch of alfalfa pasture. The hogs gained at the rate of 0.90 pound per day each, or 25 pounds per acre per day. The total gain per acre of milo for the period was 518 pounds. The milo yield was estimated as 1,874 pounds per acre, so that the estimated grain requirement per hundred pounds of gain was 342 pounds. In 1917 another lot of 12 pigs, weighing 113 pounds each, was pastured on an 0.83-acre field of milo for 14 days. They had access to alfalfa pasture, but made little use of it. They gained 25 pounds per acre per day, or 1.76 pounds per hog per day, and the total gain per acre of milo was 355 pounds. The superintendent of the Yuma Field Station reports that much of the grain was trampled into the soft soil and lost. It is generally believed that much of the feeding value of sorghum grain is lost when the grain is fed without grinding. These two tests furnished no evidence on this point. There is need for further experimentation in connection with hogging off grain-sorghum crops, as a number of important problems regarding the practice remain to be solved.

PUBLICATIONS ON SWINE PRODUCTION.

A list of publications issued by the Department of Agriculture containing useful information and suggestions of interest to swine producers on irrigated lands in the western United States is given below. Those of which the price is not stated can be obtained without charge upon application to the Secretary of Agriculture; the others may be obtained by remitting the price specified to the Superintendent of Documents, Government Printing Office, Washington, D. C. As this paper discusses only one phase of swine production on irrigated lands, it is suggested that the reader consult one or more of the publications mentioned below and also publications of the State experiment stations for information regarding other features of the industry.

Farmers' Bulletins.

No. 438. Hog Houses.
724. The Feeding of Grain Sorghums to Live Stock.
765. Breeds of Swine.
780. Castration of Young Pigs.
834. Hog Cholera: Prevention and Treatment.
873. Utilization of Farm Wastes in Feeding Live Stock.
874. Swine Management.
906. The Self-Feeder for Hogs.
913. Killing Hogs and Curing Pork.

Department Bulletin.

No. 488. Experiments in the Disposal of Irrigated Crops through the Use of Hogs.

Miscellaneous Circulars.

Bureau of Plant Industry Circular 116, part B. The Work of the Scottsbluff Experiment Farm in 1912. Price, 5 cents.

Western Irrigation Agriculture unnumbered circular (B. P. I. Document 1081). The Work of the Scottsbluff Reclamation Project Experiment Farm in 1913. Price, 5 cents.

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Western Irrigation Agriculture Circular 4. The Work of the Belle Fourche Reclamation Project Experiment Farm in 1914. Price, 5 cents.

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Western Irrigation Agriculture Circular 1. The Work of the Umatilla Reclamation Project Experiment Farm in 1914. Price, 5 cents.

Western Irrigation Agriculture Circular 13. The Work of the Truckee-Carson Reclamation Project Experiment Farm in 1915. Price, 5 cents.

Western Irrigation Agriculture Circular 19. The Work of the Truckee-Carson Reclamation Project Experiment Farm in 1916. Price, 5 cents.

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Circulars of the Office of the Secretary.

No. 80. Disposal of City Garbage by Feeding to Hogs. Price, 5 cents.
83. Swine-Judging Suggestions for Pig-Club Members. Price, 5 cents.
102. Movable Hog Houses. Price, 5 cents.

Yearbook Separate.

No. 690. Agriculture on Government Reclamation Projects. Price, 5 cents.

SUMMARY.

The irrigated lands of the western United States offer excellent opportunities for the production of pork in commercial quantities, and swine feeding has proved to be a satisfactory method of utilizing certain field crops, but the swine industry in irrigated districts in the past has experienced extremes of expansion and depression.

One of the causes of this instability is a lack of knowledge as to the possibilities of using certain irrigated field crops and as to the value of these crops when measured in terms of pork production. If full advantage is taken of the wide range of feeds available to swine growers on irrigated lands, pork production can be carried on more widely and with more assurance of success than has been the case heretofore.

Most of the published information regarding the values of field crops used in swine production is based on conditions in nonirrigated sections and can not always be applied satisfactorily under irrigated conditions. This is true particularly of those field crops which are pastured by hogs or hogged off.

Since 1912 the Department of Agriculture has been conducting experiments and making observations regarding the utilization of irrigated field crops by hog pasturing. This bulletin discusses the results of pasturing tests involving 149 lots of hogs containing a total of 3,795 animals. In these tests 89 lots containing 2,138 swine were pastured on alfalfa. The other lots were used on sweet clover, corn, field peas, and milo.

Pasturing alfalfa with hogs has been shown to be a very satisfactory method of utilizing that crop and one of the cheapest ways to produce pork. To obtain satisfactory results the alfalfa pasture must be supplemented with some carbonaceous feed. When supplemented with a 2 per cent ration of corn, barley, milo, wheat, or shorts, an acre of good alfalfa pasture can be expected to produce about 2,500 pounds of gain in live weight in a season. Gains as high as 4,292 pounds per acre were obtained in one of the tests reported here, a test in which the hogs received a 3 per cent supplementary ration of corn. The gains per acre of alfalfa depend on the size of the crop, the character of the hogs used, the method of management, and the quantity and quality of supplementary feed given. To pasture alfalfa without supplementary feed is not to be recommended.

Hogs on alfalfa pasture supplemented with about a 2 per cent ration of corn, barley, wheat, shorts, or milo will consume from 250 to 300 pounds of grain per 100 pounds of gain. In general, the grain requirement increases with the increased size of hogs and with increased grain rations. The feeding values of corn, barley, shorts, and milo as supplements to alfalfa pasture differ from one another so little that the choice among these supplements should depend on prices, cultural adaptability, and general economic conditions. When the grain supplement is to be produced by the swine grower, preference usually should be given to corn, barley, and the grain sorghums, depending on the adaptability of each of these crops to local conditions in each instance.

An acre of good alfalfa pasture supplemented with as much as a 2 per cent ration of grain has an average hog-carrying capacity of about 2,500 pounds of live weight for the growing season. Carrying capacity increases rapidly with increased grain allowance, and it varies somewhat during the growing season with the rate of crop growth.

An acre of good alfalfa pasture, if supplemented with a 2 per cent ration of corn or barley, will support 6 to 8 sows and 50 to 70 suckling spring pigs for a period of about 60 days in early summer, during which time the pigs should gain 25 to 30 pounds each. At the close of this period the pigs should be ready to go into alfalfa pasture by themselves for the remainder of the growing season.

The few tests so far conducted indicate that white sweet clover is not to be regarded as a rival of alfalfa as hog pasture. The crop is valuable to irrigation farmers chiefly for use on soils which are too wet or too salty for alfalfa.

The practice of hogging off corn and field peas is a desirable one for swine growers on irrigated lands, in that it saves labor, produces satisfactory gains on the hogs, and adds manure to the soil.

The gains made in the tests of hogging corn reported in this bulletin ranged from 183 to 1,048 pounds per acre of corn when no supplementary feed was given and from 335 to 1,377 pounds per acre where the corn was supplemented. It is estimated that in these tests an average of about 450 pounds of corn was required to produce 100 pounds of gain when no supplement was used, as compared with an average of 409 pounds when the corn was supplemented with tankage, late alfalfa pasture, or rape. Alfalfa pasture is to be preferred as a supplement to corn in hogging off enterprises on irrigated lands because of its cheapness and reliability.

The tests reported show that field peas have a high value as an irrigated crop to be hogged off. The gains in live weight per acre of peas in 17 tests ranged from 250 to 949 pounds, averaging in the

neighborhood of 600 pounds. These results compare not unfavorably with those obtained by hogging corn, when the costs of production of these crops are considered. It is to be remembered, however, that in some districts where corn grows well, field peas do not do as well as in cooler localities less favorable to corn. Field peas are particularly valuable as a crop for hogging off when the commoner grain feeds are high priced and the swine grower is seeking a substitute for them.

Horse beans are used satisfactorily in a few irrigated districts, but the crop is to be regarded as in the experimental stage for irrigation farmers generally. This crop appears to be especially susceptible to the attacks of certain fungous diseases.

While grain sorghum, particularly milo, is used to some extent in the Southwest for hogging off purposes, its chief value in swine production probably lies in its usefulness as a supplement to alfalfa pasture and as a finishing feed. When used in either of these ways the grain is cracked or ground, and its feeding value is believed to be higher than when the grain is fed whole, as in hogging.

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